CHAPTER 5

CONCLUSIONS

For MCPM based aqueous solution, calcium phosphate thin film could be established in the negative region at the current density of –10 mA/cm^2 for 3 and 5 min deposited time. Two existing phases on the film were brushite and very little monetitite at deposition time longer than 5 min, while the deposition time was shorter than 5 min the existing phase was only brushite. Film thickness was in a range of 15-20 μm and its adhesion tested by balance beam scrape adhesion tester was at 150g maximum applied load. After biomimetic processes, these films were converted partly into non-stoichiometric HAp after some interval times as observed by SEM. However, some of as-deposited phase, brushite, still remained.

For MCPM based aqueous solution with ions adding, the best condition for HAp deposited with other form of calcium phosphates was –20 mA/cm^2 for 3 and 5 min by adding $NaNO_3$ 21g and NaF 0.15g. Phases existing on film were monetite and HAp. Film thickness was in the range of 10-25 μm and its adhesion tested by balance beam scrape adhesion tester was at 100g maximum applied load. After, biomimetic processes, crystalline HAp and monetite were completely converted into amorphous HAp, which was non-stoichiometry bone-like apatite.

For MCPM based 20% V/V ethanol, the best condition for film formation was –10 mA/cm^2 for 3 and 5 min. The main constituent in film for longer deposition time (5 min) was monetite while the film gained from shorter time, the total constituents were monetite mixed with some brushite. Its thickness was in the range of 35-40 μm. Its maximum applied loads was 70g. After biomimetic process, most of monetite and brushite phases were disappeared while amorphous bone-like apatite (non-stoichiometry) appeared on all film surfaces.

Table 5.1 The total conclusion of experimental results.

Conditions	Electrolyte pH	Current density	Phases	Scratch test (Maximum applied load (g))	After soaking in R-SBF phases
MCPM electrolyte based aqueous solution	2.81	-10 mA/cm^2	Brushite and monetite	150g	Bone-like apatite and Brushite
MCPM electrolyte based aqueous solution with ions addition	2.71	-20 mA/cm^2	Monetite and hydroxyapatite	100g	Bone-like apatite
MCPM electrolyte based 20% V/V ethanol solution	2.62	-10 mA/cm^2	Monetite and Brushite	70g	Bone-like apatite
DCPD electrolyte based 1 M-H_3PO_4 solution	1.95	-300 mA/cm^2	Brushite and Monetite	N/A	N/A

From all of above, the best condition, which gave the highest adhesion between film and titanium substrate, was MCPM based aqueous solution. The best condition for bone-like apatite formed under biomimetic process was MCPM based aqueous with ions adding solution. In addition, the best condition, which gave the most smooth film surface, was MCPM based 20% V/V ethanol solution. In the other words, it would be said that phase transformation of the calcium phosphates will start from brushite to monetite and HAp as the final product.